

Educational programmes to develop clinical reasoning skills

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The role of physiotherapists has changed considerably over the last few decades. Autonomous professionals have replaced clinicians who applied technical skills under the direction of medical practitioners. The physiotherapy profession needs more than ever to produce clinicians who demonstrate competence in clinical reasoning and decision making. The challenge presented to all physiotherapists involved in teaching is to contribute to the development of clinicians who can use the complex skill of clinical reasoning in association with a sound clinical knowledge base. This paper discusses issues and strategies associated with achieving this goal.

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As a consequence of growing professional roles and responsibilities, expectations of physiotherapists have increased. There is a rising demand from the physiotherapy profession, the medical community and society for scientific validation of physiotherapy practice, accountability, self-reliance in generating knowledge and maintaining competence, effective and reliable decision making, and appropriate involvement of clients in the decision making process.

All physiotherapists involved in education are faced with the challenge of meeting these demands. Teachers need to implement strategies which will promote students' clinical reasoning abilities and knowledge development. Similarly, students and graduates participating in undergraduate, postgraduate and continuing education programmes need to develop an understanding of clinical reasoning and to become proficient in its use. This paper has been written for physiotherapists who are interested in developing their own clinical reasoning skills and the reasoning skills of others. It explores a number of key factors to consider in designing and implementing educational programmes to achieve these goals.

Understanding clinical reasoning

Clinical reasoning can be broadly interpreted as the thinking and decision making processes associated with clinical practice. It has been described as a process of hypothetico-deductive reasoning, that is, a process

of generating clinical hypotheses based on data collection and testing these hypotheses in order to make diagnostic and management decisions. This model of clinical reasoning has been supported in medical literature (Barrows and Bennet 1972, Barrows et al 1982, Elstein et al 1972, 1978) and physiotherapy literature (Dennis and May 1987, Echternach and Rothstein 1989, May and Newman 1980, Payton 1985, Thomas-Edding 1987, Wolf 1985). It has also been found that this process is not specific to clinical reasoning but relates to adult thinking in general (Gale 1982).

Recent literature emphasises the clinician's knowledge base as a key element in clinical reasoning (Bordage and Lemieux 1986, Grant and Marsden 1987). There are a number of aspects of clinical reasoning which require further research. These include further exploration of the nature of the reasoning process, the direct applicability of the hypothetico-deductive reasoning process to physiotherapy and the complex interaction between knowledge and reasoning. While awaiting these developments, physiotherapists can employ current models of clinical reasoning, and the recent emphasis on clinical knowledge, to provide a basis for promoting clinical reasoning competence.

Expanding the learner's knowledge base

An individual's knowledge base is unique. It comprises theoretical and research knowledge as well as personal knowledge which results from

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attempting to make sense of the individual's own experiences and the opinions and experiences of others. To be most useful, it needs to be constantly evolving, adequately comprehensive, relevant and accurate (given the current state of knowledge in the field and the given situation), accessible (or able to be retrieved for use) and well-organised. A well-organised knowledge base enables inter-related information to be recalled in chunks, thus providing a more comprehensive picture of relevant knowledge. The literature strongly supports the importance of the contribution of a sound, well-organised knowledge base to clinical reasoning effectiveness (Grant et al 1988, Norman 1985, Patel et al 1986).

The development of an individual's knowledge base can occur through classroom learning activities, clinical experiences, discussion of ideas with others and individual reflection. Also, learners should recognise and test the validity of what they are learning. Such activities enable individuals to develop further the soundness, scope and organisation of their knowledge base which in turn will influence their ability to make sound clinical judgements.

Within educational programmes a useful method of helping students to expand and assess their own knowledge base (in terms of accuracy, comprehensiveness and organisation) is to engage them in cognitive mapping exercises. A cognitive map is a visual representation of part of a personal knowledge base and may take the form of a flow chart, annotated diagram, an image or a map illustrating interconnected ideas. Students' cognitive maps can be reviewed to provide feedback on the accuracy, organisation and comprehensiveness of their knowledge.

Dealing with factors which influence clinical reasoning

As learners come to understand the clinical reasoning process more fully, they develop a greater appreciation of factors which impact on their

reasoning and can influence treatment reliability and validity (Echternach and Rothstein 1989, Wolf 1985). These include internal factors such as experience, individual preference, beliefs and values, or style of thinking and external influences such as the definition of the problem by someone other than the therapist or patient, current trends or fashionable protocols, exposure to treatment and time availability.

Learning and prior experience, for instance, have been found to influence the generation of hypotheses early in the information gathering process (Gale and Marsden 1982, Groen and Patel 1985). Similarly, experience can help the clinician to more readily recognise clinical patterns. It can also tempt physiotherapists to complete hypothesis generation prematurely, relying too heavily on familiar clinical patterns, which are incorrect and unsubstantiated. This premature closure can restrict information gathering, waste considerable time in the pursuit of a diagnosis which is subsequently found to be incorrect (or even worse, accepted in the face of contradictory evidence), or factors combine to restrict the clinician to a familiar but inappropriate treatment protocol without justification. Practice and exploration of clinical reasoning in action is necessary for physiotherapists to learn how experience and other factors influence their reasoning, decision making and actions and how these actions influence treatment outcomes.

Involving the client

The development of effective clinical reasoning skills involves acquiring sensitivity to the client's unique frame of reference and awareness of the client's responses to proposed or actual physiotherapy intervention. This may occur as a result of experience or tacit knowledge (Carrol 1988), or information may be sought through discussions with the client. Knowledge of the client's frame of reference and responses is an important factor in determining the path and limits of assessment and treatment procedures and the desired level of client input to

the decision making process.

In the same way that the roles and responsibilities of physiotherapists are changing, so are clients' choices, rights and responsibilities in relation to their own health. Payton et al (1990) advocate involving clients in decision making related to managing the clients' health and well-being. These authors argue that this process of client participation is based on the "recognition of the values of self-determination and the worth of the individual" (p.ix). Based on an understanding of the rights and responsibilities of clients, students and graduate physiotherapists need to develop their own guidelines for when and how much involvement the client should have in reasoning and decision making.

Mutual decision making and two-way communication require skills in negotiation as well as explaining. This is consistent with the central concept of communication which, based on its Latin root *communicare*, implies sharing of knowledge and responsibility (Elkes 1980).

Taking into consideration the knowledge, wishes and concerns of other players in the reasoning process, clinicians need to be able to develop initial diagnoses and management plans, critique and revise these as needed and justify management decisions and proposals.

Communicating and justifying clinical reasoning and decisions

The increasing autonomy of physiotherapists provides a growing freedom in clinical decision making. This prerogative brings with it a requirement for effectiveness in communicating and justifying clinical decisions to other members of the health care team, as well as to clients and their families. In addition to behaving in a competent, ethical and professional manner, clinicians need to be able to provide clear and credible explanations of the scientific and therapeutic basis for their actions within the context of the individual client's needs, wishes and situation.

Table 1.
Adult learning conditions and behaviours.

Environmental conditions	Decision making/management factors	Adult learning behaviours
Motivation	Shared goals	Problem solving
Acceptance of learner as person	Shared management	Interaction with teacher and other learners
Freedom/autonomy	Mutual decision making/planning	Active participation in learning
Individuality	Shared resource acquisition	Self-correction
Emphasis on abilities/experience	Learner involvement in learning needs diagnosis, & evaluation	Interdependence
Student-centred learning	Learner direction in posing questions/seeking answers	Critical reflection
Resource rich environment	Effective communication	Progressive mastery
Mutual respect/trust	Choice in participation	Active seeking of meaning
Teacher support/facilitation	Collaborative facilitation	Individual pacing
Learning via experience relevant to learner	Ongoing review by teacher & learners	Empowered self-direction
Praxis – integrating reflection, theory, practice, experience	Learner identification of community goals and needs as part of own learning context	Enthusiasm for learning
Interaction between learners	Learner acceptance of responsibility	Internal drive/motivation
Effective/appropriate group dynamics		Reciprocal learning
Security/support		Experiential learning

Effective communication and justification of treatment plans and actions between physiotherapy colleagues facilitates collaborative or referred client management. It is also very important where records of client management are employed in quality assurance or research projects. The power and credibility of the argument presented is a vital factor in determining the effectiveness of attempts to educate clients and the community, particularly in today's context of increasingly well-informed and health-conscious consumers of health care.

Utilising protocols within a dynamic reasoning process
Physiotherapists need to determine the

value of using data collection and treatment protocols as a part of the dynamic process of clinical reasoning. Whereas clinical reasoning involves processing constantly changing data and circumstances, routines and protocols imply a level of rigidity and lack of variation in response to individuals or situations. However, investigation routines are similar to scanning activities which have been found to occur during (medical) clinical reasoning (Barrows and Tamblyn 1980). Such scanning activities, or broad-focus inquiries which are aimed at identifying cues and ascertaining areas requiring further investigation have a number of benefits. They can assist in ensuring that adequate data is collected to alert

the clinician to significant clinical findings which are not readily apparent, to avoid premature closure of hypothesis generation and to facilitate the process of hypotheses testing and refinement.

By comparison, pedantic and unthinking use of data collection routines can be very wasteful of time and can result in a multitude of confusing data which may be very difficult to analyse, particularly for the novice. The practitioner skilled in the use of clinical reasoning is able to apply data collection routines strategically.

Similarly, treatment protocols are not inconsistent with a dynamic process of clinical reasoning. A complex and

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interactive process of decision making may result in the design of a unique management programme for a client. However, the reasoning process may also determine that a particular treatment regime or ward protocol is the most desirable option. Alternatively, the decision could be taken to modify the nature or pattern of delivery of a commonly used regime or protocol to suit the individual client's needs or opportunities and constraints of the client's situation.

Selecting teaching strategies and curriculum designs to teach clinical reasoning

Decisions regarding curriculum design and teaching/learning strategies need to take into consideration the complex nature of the process of clinical reasoning, the variability of reasoning processes among different people and the potential impact on current learning, of the learners' previous learning experiences. There is likely to be a considerable overlap between the ability of learners to be self-directed in their learning projects and their ability to demonstrate self-direction in generating and testing clinical knowledge and in making clinical decisions based on their own experiences and judgements.

Therefore, if physiotherapists wish to promote effective, autonomous clinical reasoning and continue to develop their knowledge, the learning environment should promote learner self-direction and responsibility as is advocated in adult learning theory and research. Table 1 lists desirable conditions for adult learning and effective adult learning behaviours which occur in these conditions. This table has been derived from adult learning literature (Bagnall 1978, Brookfield 1986, Hammond and Collins 1991, Knowles 1980, Knox 1977, Mezirow 1981). It can serve as a useful guide to designing educational programmes which promote adult learning.

Clinical reasoning may be taught as a separate subject within a physiotherapy

curriculum to examine this complex skill in detail. Alternatively, clinical reasoning could be incorporated as a generalised aspect of all components of the curriculum. This strategy encourages students to regard clinical reasoning as an integral part of all subject areas. Problem-based learning is an example of a generalised approach which can promote the development of problem solving skills (Jones 1988). It has been adopted successfully in physiotherapy schools (Barr 1977, Perry 1981).

Teaching strategies which can be employed to promote the development of clinical reasoning skills include small group learning tutorials. These can entail role playing or practice of thinking and communication skills using video or simulated clinical settings (Higgs 1990). Students can be asked to discuss the management of hypothetical cases and justify their decisions on the basis of collected data or knowledge of pathological or physiological processes. Questions from experts enable students to review their thinking and explore their attitudes and values. Helping students to become aware of their own thoughts and in turn, gaining access to students' thoughts in order to assess their reasoning and provide feedback, is a valuable part of fostering clinical reasoning ability (Jones, *in press*).

Developing clinical reasoning in the clinical setting

The clinical setting provides a real-life context characterised by multiple or conflicting problems, with many influences on both the information presented and the possible outcomes (Carnevali et al 1984). Within this complex environment, physiotherapy graduates and students can expand their clinical knowledge and develop their reasoning and planning competence. It has been found that physiotherapists and physicians seem to perform better in a real treatment situation and to improve with practice (Dennis and May 1987, Gale and Marsden 1982).

However, it is not an easy task to practise reasoning in the clinical

setting. The very factors which make the clinic an ideal one in which to fully appreciate the nature of clinical reasoning also make it a difficult context in which to develop and implement this complex skill. For instance, the demands of time and the pressures of personal and professional expectations can be very high. Taking time out to reflect on experience and examine learners' reasoning may be regarded as a luxury. Similarly, for busy clinicians and students faced with the task of trying to remember their preparatory learning and apply it effectively and appropriately in situations which have real consequences, reflection during action and the monitoring of thinking processes (metacognition) are behaviours which are not simple or easily performed.

It is important therefore, to see the learning process as involving a close integration between the academic and clinical programmes. In order to develop metacognitive and reflection skills, activities conducted in classroom learning settings where time can be manipulated or suspended, would be of value prior to practising these skills in clinical contexts. Conversely, such skills could be simply labelled mental gymnastics if the learner fails to develop the capacity to employ them during in the real world of the clinic. Also, physiotherapists need to recognise the value and validity of new knowledge developed in the clinic through reflection and discussion following action/experience. Such knowledge, then, needs to be brought into the classroom to enrich classroom learning experiences.

Helping students to make clinical reasoning a conscious and strategic part of their clinical practice has several benefits. Clinicians and students learn to express their opinions and ideas. They develop a greater awareness of how internal factors (such as values and attitudes) influence their clinical reasoning and a greater ability to deal with these factors. The reader may refer to Davis (1989) for a discussion on values as determinants of behaviour in the therapeutic role and

Watts (1990) for useful guidelines on the design, implementation and evaluation of clinical education programmes.

The clinical setting plays an important part in developing the student's knowledge base. Learned theory, data and techniques are challenged by the inherent variability, complexity and subjectivity of the real world. Text-book learning is tested and rejected, modified or confirmed prior to being absorbed into the individual's knowledge base. Learning is deepened, broadened and coloured by personal experience of the clinical role and by exposure to behaviours and ideas of fellow students and clinical role models. The latter is particularly important since exploration of the greater experience-based and tacit knowledge of experienced clinicians enables students to develop a rich range of perspectives and alternatives which they may adopt or use as comparisons for their own developing ideas.

Conclusion

The clinical reasoning process provides a framework for integrating the complex and variable elements of clinical practice. Knowledge and experience of this process can enhance the effectiveness and efficiency of clinical intervention and ensure its relevance to clients' needs. In addition, developing clinical reasoning skills can enable clinicians to examine and justify treatment reliability and validity and clearly communicate these to their clients and other clinicians.

Teaching and learning clinical reasoning skills presents a challenging task for physiotherapists. Knowledge development is a fundamental part of this process. It is argued that consideration needs to be given to developing strategies for teaching clinical reasoning which consider the needs of the learner and the nature of the context. Application of the principles of adult learning and an environment which promotes reflection and feedback, are essential characteristics of these strategies.

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References

- Bagnall RG (1978): Principles of adult education in the design and management of instruction. *Australian Journal of Adult Education* 28:19-27.
- Barr JS (1977): A problem solving curriculum design in physical therapy. *Physical Therapy* 57:262-272.
- Barrows HS and Bennet K (1972): The diagnostic (problem solving) skill of the neurologist. *Archives of Neurology* 26:273-277.
- Barrows HS, Norman GR, Neufeld VR, and Feightner JW (1982): The clinical reasoning of randomly selected physicians in general medical practice. *Clinical and Investigative Medicine* 5:49-55.
- Barrows HS and Tamblyn RM (1980): Problem-based learning - An approach to medical education. New York: Springer.
- Bordage G and Lemieux M (1986): Some cognitive characteristics of medical students with and without diagnostic reasoning difficulties. Proceedings of the 25th Annual Conference of Research in Medical Education of the American Association of Medical Colleges, New Orleans, pp.185-190.
- Brookfield SD (1986): Understanding and facilitating adult learning. San Francisco: Jossey-Bass.
- Carnevali D, Mitchell P, Woods N, and Tanner C (1984): Diagnostic reasoning in nursing. Philadelphia: JB Lippincott.
- Carroll E (1988): The role of tacit knowledge in problem solving in the clinical setting. *Nurse Education Today* 8:140-147.
- Davis CM (1989): Patient/practitioner interaction. Thorofare, New Jersey: Slack Inc.
- Dennis JK and May GM (1987): Practice in the year 2000: Expert decision making in physical therapy. Proceedings of the 10th International Congress of the World Confederation of Physical Therapy. Sydney, pp. 543-551.
- Echternach JL and Rothstein JM (1989): Hypothesis oriented algorithms. *Physical Therapy* 69:559-564.
- Elkes J (1980): Foreword. In Gerrard BA, Boniface WJ, and Love BH: Interpersonal skills for health professionals. Virginia: Reston, pp. xi-xii.
- Elstein A, Kagan W, Shulman L, Jason H, and Loupe M (1972): Methods and theory in the study of medical enquiry. *Journal of Medical Education* 47:85-92.
- Elstein AS, Shulman LS, and Sprafka SA (1978): Medical problem solving: An analysis of clinical reasoning. Cambridge, Massachusetts: Harvard University Press.
- Gale J (1982): Some cognitive components of the diagnostic thinking process. *British Journal of Educational Psychology* 52:64-76.
- Gale J and Marsden P (1982): Clinical problem solving: the beginning of the process. *Medical Education* 16:22-26.
- Grant J and Marsden P (1987): The structure of memorized knowledge in students and clinicians: an explanation for diagnostic expertise. *Medical Education* 21:92-98.
- Grant R, Jones M, and Maitland GD (1988): Clinical decision making in upper quadrant dysfunction. In Grant R (Ed.): Physical therapy of the cervical and thoracic spine. New York: Churchill Livingstone, pp. 51-79.
- Groen GJ and Patel VL (1985): Medical problem solving: some questionable assumptions. *Medical Education* 19:95-100.
- Hammond M and Collins R (1991): Self-directed learning: Critical practice. London: Kogan Page.
- Higgs J (1990): Fostering the acquisition of clinical reasoning skills. *New Zealand Journal of Physiotherapy* 18:13-17.
- Jones M (1988): Clinical reasoning process in manipulative therapy. University of Cambridge: IFOMPT Congress proceedings and posters.
- Jones M (in press): Clinical reasoning in manipulative therapy. In Boyling J, and Palastanga N: Modern manual therapy - The vertebral column. (2nd ed.) Edinburgh: Churchill Livingstone.
- Knowles MS (1980): The modern practice of adult education - From pedagogy to andragogy. New York: Cambridge - The Adult Education Company.
- Knox AB (1977): Adult development and learning. San Francisco: Jossey-Bass.
- May BJ and Newman J (1980): Developing competence in problem solving: A behavioural model. *Physical Therapy* 60:1140-1145.
- Mezirow J (1981): A critical theory of adult learning and education. *Adult Education* 32:3-24.
- Norman GR (1985): Problem-solving skills, solving problems and problem based learning. *Medical Education* 22:279-286.
- Patel VL, Groen GJ, and Frederiksen CH (1986): Differences between medical students and doctors in memory for clinical cases. *Medical Education* 20:3-9.
- Payton OD (1985): Clinical reasoning process in physical therapy. *Physical Therapy* 65:924-928.
- Payton OD, Nelson CE, and Ozer MN (1990): Patient participation in program planning: A manual for therapists. Philadelphia: FA Davis.
- Perry J (1981): A model for designing clinical education. *Physical Therapy* 61:1427-1432.
- Thomas-Edding D (1987): Clinical problem solving in physical therapy and its implications for curriculum development. Proceedings of the 10th International Congress of the World Confederation of Physical Therapy. Sydney, pp. 100-104.
- Watts NT (1990): Handbook of clinical teaching. Edinburgh: Churchill Livingstone.
- Wolf SL (1985): Clinical decision making in physical therapy. New York: FA Davis Company.